Output tables for the test of Multiple comparisons.

December 17, 2022

1 Average rankings of Friedman test

Average ranks obtained by applying the Friedman procedure

Algorithm	Ranking
MEABC	6.5172
ABCADE	3.6207
ABCNG	5.2069
SHADE	2.7241
MAPSO	3.9655
TAPSO	4.2069
MEEABC	1.7586

Table 1: Average Rankings of the algorithms

Friedman statistic considering reduction performance (distributed according to chi-square with 6 degrees of freedom: 90.931034.
P-value computed by Friedman Test: 4.6461168246025863E-11.

2 Post hoc comparisons

Results achieved on post hoc comparisons for $\alpha = 0.05$, $\alpha = 0.10$ and adjusted p-values.

2.1 P-values for $\alpha = 0.05$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm
21	MEABC vs. MEEABC	8.388063	0	0.002381
20	MEABC vs. SHADE	6.686137	0	0.0025
19	ABCNG vs. MEEABC	6.078307	0	0.002632
18	MEABC vs. ABCADE	5.105778	0	0.002778
17	MEABC vs. MAPSO	4.497947	0.000007	0.002941
16	ABCNG vs. SHADE	4.376381	0.000012	0.003125
15	TAPSO vs. MEEABC	4.315598	0.000016	0.003333
14	MEABC vs. TAPSO	4.072466	0.000047	0.003571
13	MAPSO vs. MEEABC	3.890116	0.0001	0.003846
12	ABCADE vs. MEEABC	3.282286	0.00103	0.004167
11	ABCADE vs. ABCNG	2.796021	0.005174	0.004545
10	SHADE vs. TAPSO	2.613672	0.008958	0.005
9	MEABC vs. ABCNG	2.309757	0.020902	0.005556
8	ABCNG vs. MAPSO	2.18819	0.028656	0.00625
7	SHADE vs. MAPSO	2.18819	0.028656	0.007143
6	ABCNG vs. TAPSO	1.762709	0.07795	0.008333
5	SHADE vs. MEEABC	1.701926	0.088769	0.01
4	ABCADE vs. SHADE	1.58036	0.114025	0.0125
3	ABCADE vs. TAPSO	1.033312	0.301458	0.016667
2	ABCADE vs. MAPSO	0.607831	0.5433	0.025
1	MAPSO vs. TAPSO	0.425481	0.670486	0.05

Table 2: P-values Table for $\alpha = 0.05$

Holm's procedure rejects those hypotheses that have an unadjusted p-value ≤ 0.004545.

2.2 P-values for $\alpha = 0.10$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm
21	MEABC vs. MEEABC	8.388063	0	0.004762
20	MEABC vs. SHADE	6.686137	0	0.005
19	ABCNG vs. MEEABC	6.078307	0	0.005263
18	MEABC vs. ABCADE	5.105778	0	0.005556
17	MEABC vs. MAPSO	4.497947	0.000007	0.005882
16	ABCNG vs. SHADE	4.376381	0.000012	0.00625
15	TAPSO vs. MEEABC	4.315598	0.000016	0.006667
14	MEABC vs. TAPSO	4.072466	0.000047	0.007143
13	MAPSO vs. MEEABC	3.890116	0.0001	0.007692
12	ABCADE vs. MEEABC	3.282286	0.00103	0.008333
11	ABCADE vs. ABCNG	2.796021	0.005174	0.009091
10	SHADE vs. TAPSO	2.613672	0.008958	0.01
9	MEABC vs. ABCNG	2.309757	0.020902	0.011111
8	ABCNG vs. MAPSO	2.18819	0.028656	0.0125
7	SHADE vs. MAPSO	2.18819	0.028656	0.014286
6	ABCNG vs. TAPSO	1.762709	0.07795	0.016667
5	SHADE vs. MEEABC	1.701926	0.088769	0.02
4	ABCADE vs. SHADE	1.58036	0.114025	0.025
3	ABCADE vs. TAPSO	1.033312	0.301458	0.033333
2	ABCADE vs. MAPSO	0.607831	0.5433	0.05
1	MAPSO vs. TAPSO	0.425481	0.670486	0.1

Table 3: P-values Table for $\alpha = 0.10$

Holm's procedure rejects those hypotheses that have an unadjusted p-value ≤ 0.011111.

2.3 Adjusted p-values

i	hypothesis	unadjusted p	p_{Holm}
1	MEABC vs .MEEABC	0	0
2	MEABC vs .SHADE	0	0
3	ABCNG vs .MEEABC	0	0
4	MEABC vs .ABCADE	0	0.000006
5	MEABC vs .MAPSO	0.000007	0.000117
6	ABCNG vs .SHADE	0.000012	0.000193
7	TAPSO vs .MEEABC	0.000016	0.000239
8	MEABC vs .TAPSO	0.000047	0.000651
9	MAPSO vs .MEEABC	0.0001	0.001303
10	ABCADE vs .MEEABC	0.00103	0.012356
11	ABCADE vs .ABCNG	0.005174	0.05691
12	SHADE vs .TAPSO	0.008958	0.089575
13	MEABC vs .ABCNG	0.020902	0.188115
14	ABCNG vs .MAPSO	0.028656	0.229246
15	SHADE vs .MAPSO	0.028656	0.229246
16	ABCNG vs .TAPSO	0.07795	0.467698
17	SHADE vs .MEEABC	0.088769	0.467698
18	ABCADE vs .SHADE	0.114025	0.467698
19	ABCADE vs .TAPSO	0.301458	0.904374
20	ABCADE vs .MAPSO	0.5433	1.0866
21	MAPSO vs .TAPSO	0.670486	1.0866

Table 4: Adjusted p-values